The SIRTF Science Center Enters the Home Stretch

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Abstract. The Space Infrared Telescope Facility (SIRTF) will be launched in July 2002, and will perform an extended series of science observations at wavelengths ranging from 20 to 160 microns for five years or more. The California Institute of Technology has been selected as the home for the SIRTF Science Center (SSC). The SSC is responsible for evaluating and selecting observation proposals, providing technical support to the science community, performing mission planning and science observation scheduling activities, instrument calibration during operations and instrument health monitoring, production of archival quality data products, and management of science research grants. The SSC is responsible for design, development, and operation of the Science Operations System (SOS) which will support the functions assigned to the SSC by NASA. This paper describes the top level architecture of the SOS, the current status of the evolution of the SSC systems and capabilities, and an overview of plans for remaining development and testing prior to launch.

1. Introduction

In the past year, six Legacy Science Teams have been selected to conduct extensive observation programs with the Observatory and to release the data from those programs rapidly to the science community during flight operations. Electronic mission planning and proposal submission tools were provided by the SSC to support proposal submission and selection of the six teams in the fall of 2000. These six teams provided approximately 3000 individual observation requests to the SSC in October 2001. These observations, plus over 6000 observation requests previously submitted by the Guaranteed Time Observers (GTOs), will comprise the majority of science observations during the first year of SIRTF operations. The SOS is now in the final stages of development, with over 1.2 million lines of code and data systems now in place supporting

Innovative web-based tools for planning observations with SIRTF have been successfully downloaded to hundreds of user sites. Extensive final work on the instrument data processing pipelines is now underway using the latest pre-flight instrument test data obtained under operating temperature conditions.

SIRTF development and operations activities are highly cost constrained. The cost constraints have impacted the design of the SOS in several ways. The Science Operations System has been designed to incorporate a set of highly efficient tools which will make it possible for scientists to propose observation

sequences in a rapid and automated manner. The use of highly automated tools for requesting observations will simplify the long-range observatory scheduling process, and the short-term scheduling of science observations. Pipeline data processing will be highly automated and data-driven. An incremental ground data system development approach has been adopted, featuring periodic deliveries that are validated with the flight hardware throughout the various phases of system level development and testing.

2. System Overview

The Science Operations System (SOS) design includes modules for each of the major functions supported by the SSC. A block diagram of the system is shown in Figure 1. The Science User Tools consist of a variety of Java-based software elements that are downloaded to the user's PC or workstation. Users can maintain a catalog of observation targets on their home machines. They can select from one of seven observing modes across the three payload instruments, and input observation parameters to generate an AOR (Astronomical Observation Request). Users can build a library of desired observations on their home systems, and then, when completed, download the final set of observation requests to the SSC. Screen dumps showing data visualization of specific observation requests, and a set of AOR examples maintained on the observers computer during proposal preparation are shown in Figure 2. The AOR/IER Expansion Editor is used to expand each individual AOR (or Instrument Engineering Request IERs) into spacecraft and instrument commands. The user is provided with the resource estimate for each observation following expansion of the AOR or IER into a command sequence. This feedback enables users to provide observation programs to the SSC that fit within their time allocations.

The Science Observations Data Base (SODB) is used at the SSC to hold all information submitted by the community, and will eventually encompass the project archival data bases as well. Command expansions are transferred to the flight operations systems at JPL for execution via transfer from the SODB to JPL operational data systems. Downlink data is transferred to the SODB by the JPL flight operations system when data are acquired by the Observatory and transferred to the JPL ground data support systems from the Deep Space Network.

The SSC pipeline processing is an automated process that is initiated when data requested by the uplink planning system are delivered to the SODB. The SSC is currently designing and implementing the pipeline systems in conjunction with the instrument Principal Investigators and their support teams.

3. Current Status

The Science Observations Database (SODB) at the SSC now contains over 10,000 AORs, representing the detailed observation requests from the GTOs, Legacy Teams, and the 100 hour First Look Survey to be performed immediately after In-Orbit Checkout. These AORs will be used to do detailed planning of the first year of science observations.

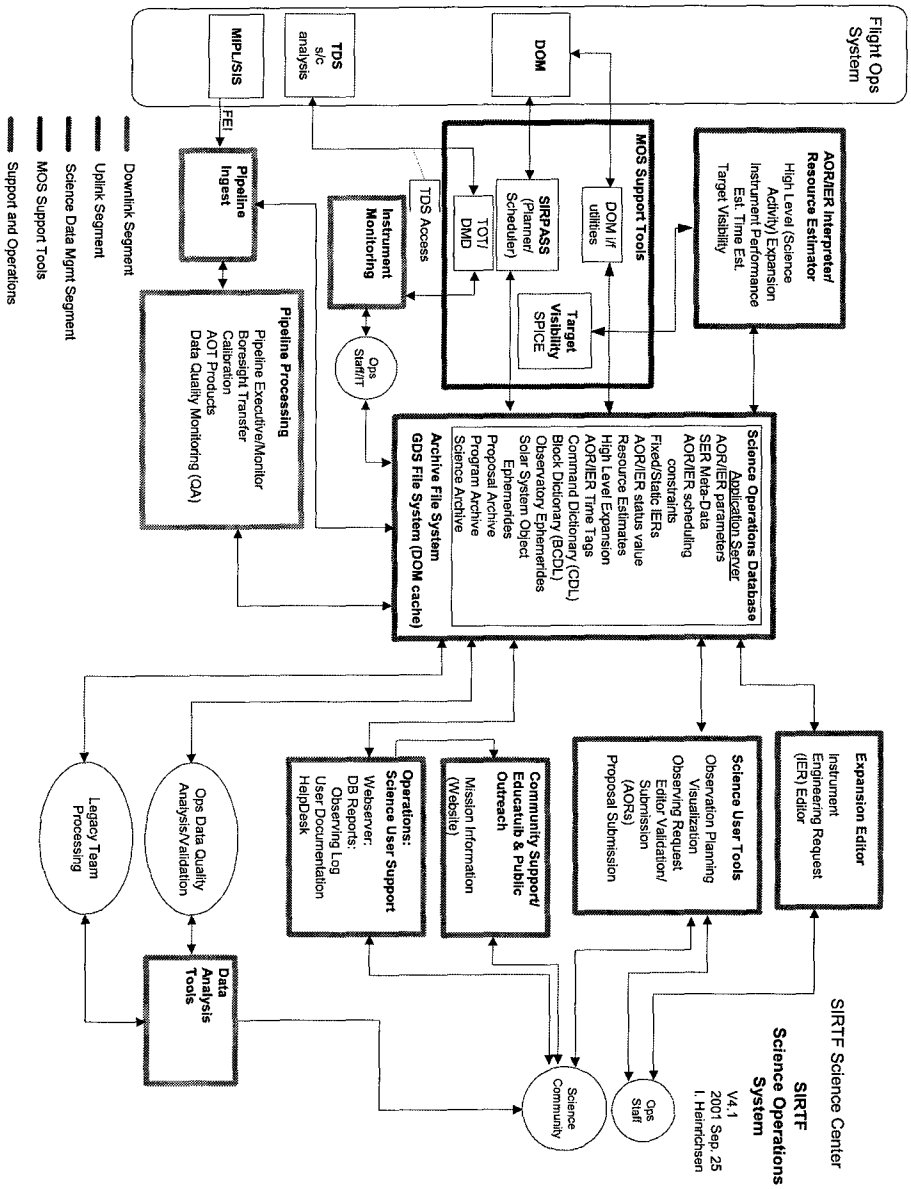

Figure 1. SIRTF Science Operations System

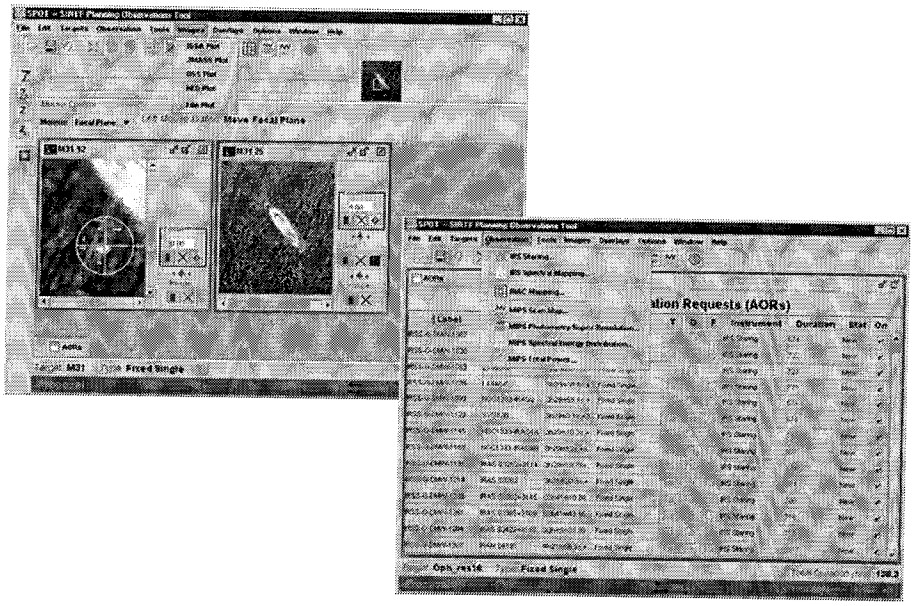

Figure 2. Screen Dumps

4. Future Work

The focus of effort at the SSC is now shifting to completion of the final observation templates to be completed prior to launch, completion of the pipeline processing system supporting instrument calibration and processing of the data produced by the AORs, and participation in sequence generation and testing using spacecraft simulators at Lockheed in Sunnyvale. Following validation of flight sequences with the test laboratory, selected sequences will be run on the flight Observatory prior to launch as a final validation of the ground data system (including the SOS).

5. Acknowledgements

It is a pleasure to represent the efforts of the outstanding staff of the SIRTF Science Center in designing, developing, implementing, testing and operating the systems that will be used to support SIRTF operations, and their efforts in supporting the external scientific community. The cooperation received from the three instrument Principal Investigators, Dr. Giovanni Fazio, Dr. James Houck, and Dr. George Rieke, is gratefully acknowledged. Thanks also to the SSC Director, Dr. B. Thomas Soifer, and Deputy Director, Dr. George Helou, to Project Manager Dave Gallagher and Michael Werner, Project Scientist at JPL, for their support. This work was performed at the California Institute of Technology under contract to the National Aeronautics and Space Administration.